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Knowledge, attitudes and behavior of physicians regarding predictive genetic tests for breast and colorectal cancer

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ABSTRACT

Background. Genetic testing for cancer susceptibility is an emerging technology in medicine. This study assessed the knowledge, attitudes and professional behavior of Italian physicians regarding the use of predictive genetic tests for breast and colorectal cancer, including the *BRCA1/2* and *APC* tests.

Methods. A cross-sectional survey of a random sample of Italian physicians was performed in 2010 through a self-administered questionnaire.

Results. A response rate of 69.6% (1079 questionnaires) was achieved. A significant lack of knowledge was detected, particularly for *APC* testing. Less than half of the physicians agreed on the importance of efficacy and cost-effectiveness evidence in the selection of predictive genetic tests to be offered to the patients. Multiple logistic regression analyses showed that education had a positive influence on knowledge, attitudes and, to a lesser extent, professional use. The factor most strongly related to the physicians' use of genetic testing was patients requests for breast (odds ratio = 12.65; 95% confidence interval 7.77–20.59) or colorectal cancer tests (odds ratio = 7.02; 95% confidence interval 3.61–13.64). A high level of interest for specific training was reported by almost all physicians surveyed.

Conclusions. Targeted educational programs are needed to improve the expertise of physicians, and, ultimately, to enhance the appropriate use of genetic tests in clinical practice.

Introduction

Among predictive genetic testing for complex diseases, tests for breast and colorectal cancer, if used appropriately, have been demonstrated to be efficacious and cost-effective (Becker et al., 2011). Physicians play a key role in properly incorporating emerging DNA technologies in health care (Anon, 2011; Feero and Green, 2011) because they have to be adept not only at using genetic tests in clinical care but also in explaining the test results and their limitations to patients.

Calls for enhanced genomic education for health care professionals predate the completion of the Human Genome Project (Collins, 1997). Despite this, several surveys performed in the U.S., Europe and Canada show that doctors are not prepared for the increasing use of genetics in clinical care (Acton et al., 2000; Batra et al., 2002; Bellcross et al., 2011; Bethea et al., 2008; Burke et al., 2009; Carroll et al., 2008; Escher and Sappino, 2000; Freedman et al., 2003; Klitzman et al., 2012; Mehnert et al., 2003; Nippert et al., 2011; Pichert et al., 2003; Sabatino et al., 2007; Shields et al., 2008; Sifri et al., 2003; Toiviainen and Hemminki, 2001; Trivers et al., 2011; Van Riel et al., 2010; Welkenhuysen and Evers-Kiebooms, 2002; White et al., 2008; Wideroff et al., 2003; Wideroff et al., 2005; Wilkins-Haug et al., 2000). Many physicians do not have any specific education and the vast majority does not feel they have the needed training and knowledge for the appropriate use of genetic testing to guide prevention or treatment decisions (Anon, 2011; Feero and Green, 2011). Recent surveys tested the effectiveness of educational interventions at improving the competency of doctors in this field (Bethea et al., 2008; Carroll et al., 2008, 2009; Drury et al., 2007).

The present study assessed the knowledge, attitudes, and professional behavior of a random sample of Italian physicians toward the use of predictive genetic testing for breast and colorectal cancer, particularly the *BRCA 1/2* and *APC* tests. A variety of determinants were explored, including education.

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Methods

In 2010, a self-administered anonymous questionnaire was e-mailed to 1670 physicians randomly selected from the registers of the Board of Physicians of Provinces of Rome and Florence. The physicians were chosen irrespective of their specialty because this information is not recorded in the registers. The online questionnaire could only be answered once. Second and third questionnaires were e-mailed to non-responders 3 and 6 months after the initial e-mail. To maximize the response rate, telephone calls were placed before each of the follow-up mailings. A total of 107 physicians could not be contacted by telephone because their numbers were not available.

The questionnaire (a copy is available upon request) comprised a series of questions designed to assess the following: i) the physicians' demographics and personal and professional characteristics; ii) their knowledge, attitudes, and professional use of genetic tests for breast and colorectal cancer; iii) their self-estimated level of knowledge and training needs.

Knowledge about predictive genetic tests for cancer was investigated through six questions using a three-point options Likert scale ("agree", "uncertain," and "disagree") [see Table 2(A) for the actual items used]. Additional four multiple-choice questions were designed to evaluate the physicians' knowledge concerning the prevalence of hereditary breast cancer and inherited forms of colorectal cancer and the penetrance of *BRCA1*/*BRCA2* and *APC* mutations [see Table 2(B)]. A Likert three-point scale was used to assess the physicians' attitudes through seven questions (see Table 4). In the behavior section, physicians were asked if they had administered genetic tests for breast and colorectal cancer to their patients during the previous 2 years and queried about the importance of genetic counseling and collecting information about the family and personal history of cancer. The final set of questions required the physicians to assess their own level of knowledge according to a four-answer format ("inadequate," "sufficient," "good," and "excellent") and their need for training ("yes/no" answer).

Extensive pre-administration piloting was conducted with a convenience sample of physicians similar to the study population. A clear need to slim down the questionnaire emerged. Therefore, only questions concerning *APC* mutations were included among the knowledge items concerning the inherited forms of colorectal cancer, thus excluding questions regarding gene mutations associated with the Lynch syndrome. Other minor revisions included changes to the questionnaire item wording and format.

Statistical analysis

Multiple logistic regression analysis was performed. Five models were built to identify the predictors of physicians knowledge of predictive genetic testing for breast and colorectal cancer (Models 1 and 2), attitudes (Model 3), and professional use of predictive genetic tests for breast and colorectal cancer (Models 4 and 5). For purposes of analyses, the outcome variables "knowledge" and "attitudes" in Models 1–3, originally consisting of multiple categories, were collapsed into two levels. In brief, for the variable knowledge physicians were divided in those who agreed with all correct responses versus all others, while for attitudes responders were grouped into those who showed a positive attitude in at least 70% of the questions versus all others (see Table 3 for the details of dichotomization). The following physician characteristics were initially tested in all models as predictor variables: location; gender; age; exposure to cancer genetic testing during graduate/postgraduate courses; attendance to postgraduate epidemiology and Evidence Based Medicine (EBM) courses; knowledge of the English language; internet access in the workplace; hours per week dedicated to continuing medical education; the average number of patients treated in a typical week; patient requests for genetic tests in the previous year; the presence of genetic testing laboratories in the geographical area of professional activity; and a personal or family history of breast or colorectal cancer. The variable "adequate knowledge" was also included in the model concerning attitudes, and the variables "adequate knowledge" and "positive attitudes" were included in the models concerning the professional use of predictive genetic tests (see Table 3 for the details of dichotomization).

The model building strategy suggested by Hosmer and Lemeshow (2000) was used and included the following steps: (a) univariate analysis of each variable and inclusion if the *p*-value was lower than 0.25; (b) backward elimination of each variable that did not contribute to the model on the ground of the Likelihood Ratio Test using a cut-off of 0.05 level of significance; variables whose exclusion markedly altered the coefficient of the remaining variables were kept in the model; (c) testing of interaction terms using a cut-off of 0.15 level of significance. Adjusted odds ratio (OR) and 95% confidence intervals (CI) were calculated. All statistical calculations were performed using Stata version 8.0 (College Station, Texas, Stata Corporation, 2003).

Results

Study population

Of the original sample of 1670 physicians, 120 were ineligible because they were retired or no longer in clinical practice. The final sample size included 1550 physicians, of which 1079 responded (overall response rate: 69.6%). Responders and non-responders were comparable in terms of demographic characteristics (location, gender, and age; $p > 0.05$). Most responding physicians were from Rome (73.8% of responders vs. 76.9% of non-responders) and male (56.2% of responders vs. 58.9% of non-responders), with a mean age of 50.7 ($\pm$11.5) years (50.0 years for non-responders). The demographic characteristics of the sample were similar to those of all Italian physicians, as 60.6% of the members of the National Board of Physicians are male and have a similar age distribution (ENPAM, 2012). Other demographics, professional and personal characteristics of the responding physicians are listed in Table 1.

Knowledge

Italian physicians' knowledge of predictive genetic testing for cancer appeared adequate in terms of *BRCA1*/*BRCA2* testing, although knowledge of *APC* testing was lacking [Table 2(A)]. Almost half of the sample (42.8%) answered all three questions about *BRCA1/2* testing correctly. This knowledge was improved if physicians were exposed to cancer genetic testing during graduate or postgraduate training, and with the increase in the amount of time dedicated to continuing medical education. Female physicians were more likely to have adequate knowledge about *BRCA1/2* testing, and this knowledge increased if genetic testing laboratories were located in the same geographical area as the physicians' workplace (Model 1 in Table 3). Only 16.9% of physicians provided correct answers to all three questions about *APC* testing. This knowledge, as in the previous case, increased with exposure to cancer genetic testing during graduate and postgraduate training and with the amount of time dedicated to continuing medical education (Model 2 in Table 3).

Physicians' knowledge was satisfactory on the penetrance of *BRCA1*/*BRCA2* mutations, but not regarding the prevalence of hereditary breast cancer. Most physicians knew that the absolute risk of developing breast cancer in the presence of *BRCA1*/*BRCA2* mutations is 40–80%, but less than one third recognized that the percentage of breast cancer cases associated with *BRCA1*/*BRCA2* mutations is 1–10% [Table 2(B)]. By contrast, knowledge concerning inherited forms of colorectal cancer was inadequate, as none of the surveyed physicians knew that the percentage of colorectal cancer cases associated with *APC* mutations is less than 5%, and only a small proportion of physicians recognized that the absolute risk of developing cancer in the presence of *APC* mutations is 100% [Table 2(B)].

Attitudes

Attitudes toward predictive genetic testing for breast and colorectal cancer were quite heterogeneous (Table 4). Although nearly all physicians agreed that predictive genetic testing increases the chances of prevention, only a minority appeared to accept that the principles of